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Izmailov

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(54) **ADJUSTABLE HANDHELD TOOL**

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(51) **Int. Cl.**
B24B 23/00 (2006.01)

(52) **U.S. Cl.** **451/344**; 451/359

(58) **Field of Classification Search** 451/344, 451/354, 355, 356, 357, 358, 359
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,339,572 A * 8/1994 Eicher 451/358
6,155,916 A * 12/2000 Rudolf et al. 451/344
6,602,122 B1 * 8/2003 Rudolf et al. 451/344
7,175,513 B2 * 2/2007 Folin 451/359
2003/0190877 A1 * 10/2003 Gallagher et al. 451/344
2006/0025060 A1 * 2/2006 Funk 451/358
2006/0258274 A1 * 11/2006 Oki et al. 451/358
2008/0014844 A1 * 1/2008 Pontieri 451/359
2008/0102739 A1 * 5/2008 Sun et al. 451/358

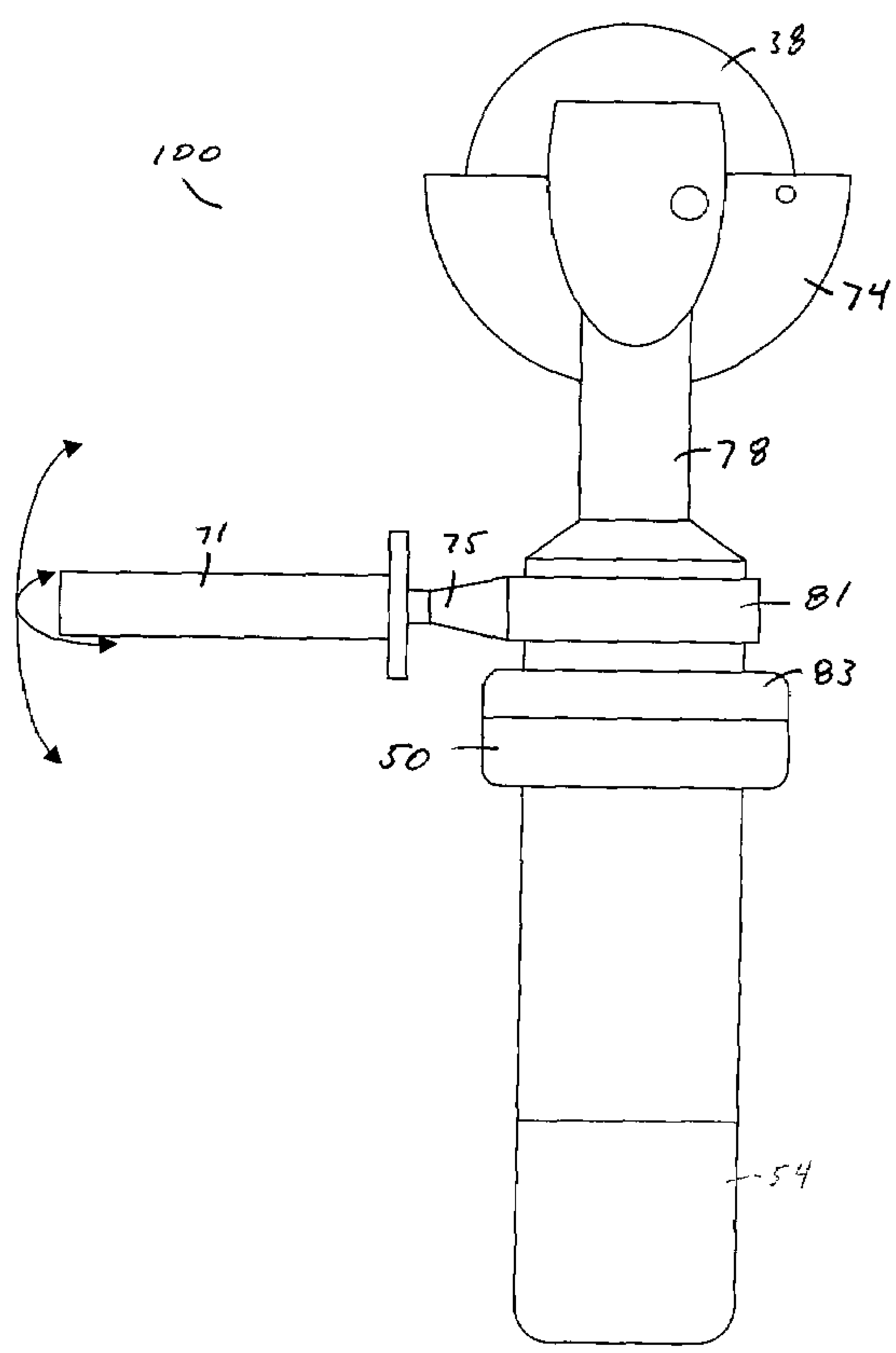
* cited by examiner

Primary Examiner—Eileen P. Morgan

(57) **ABSTRACT**

An adjustable handle is attached to a power tool having a tool head and a motor housing. When the handle is loosened, the tool head can rotate relative to the motor housing and the handle can be rotated relative to the power tool. When the handle is tightened, the tool head does not rotate relative to the motor housing and the handle does not rotate relative to the power tool. The adjustable handle allows the user to easily reconfigure the power tool for use in confined spaces or special applications.

20 Claims, 11 Drawing Sheets



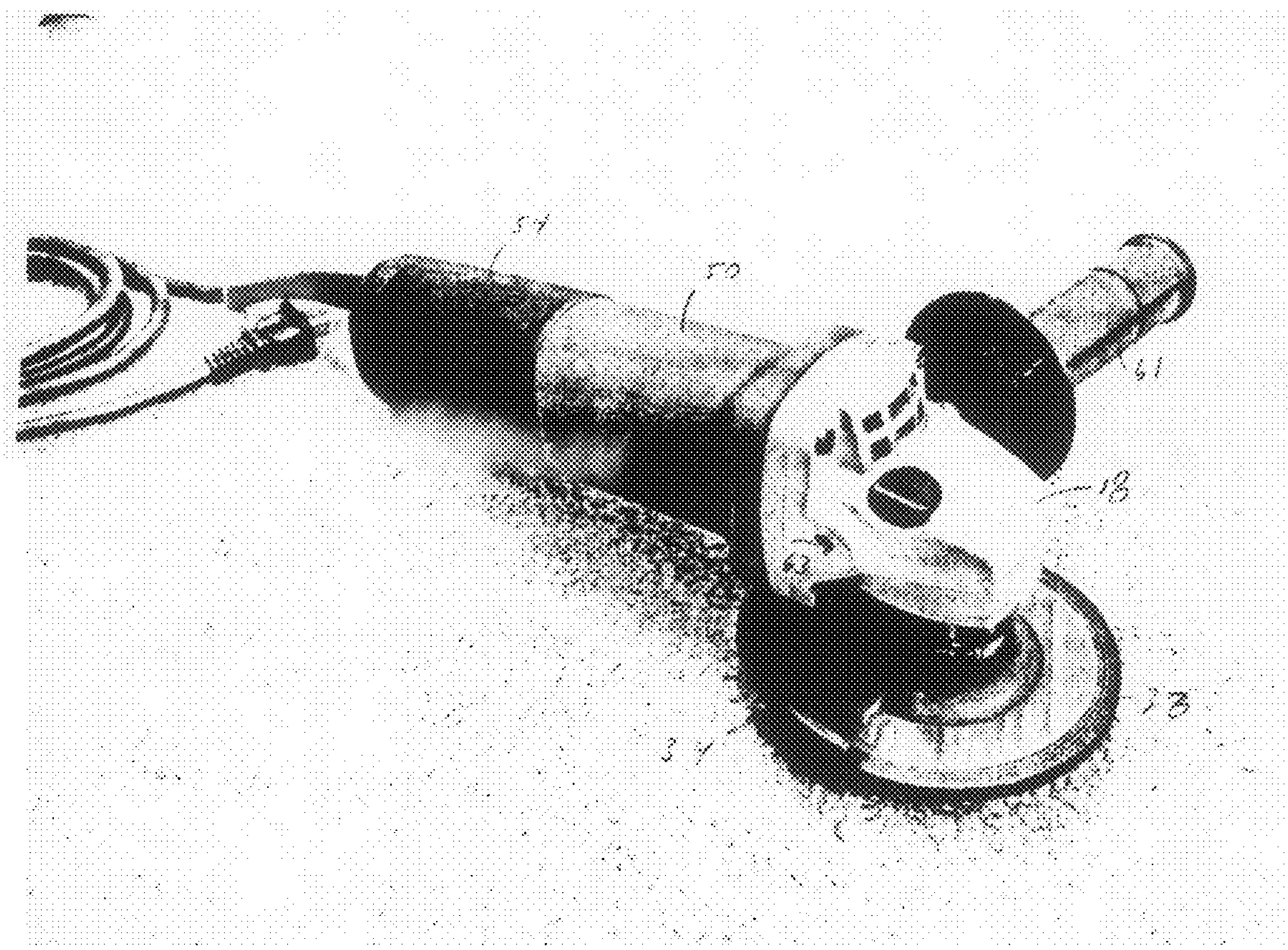


FIG. 1
(PRIOR ART)

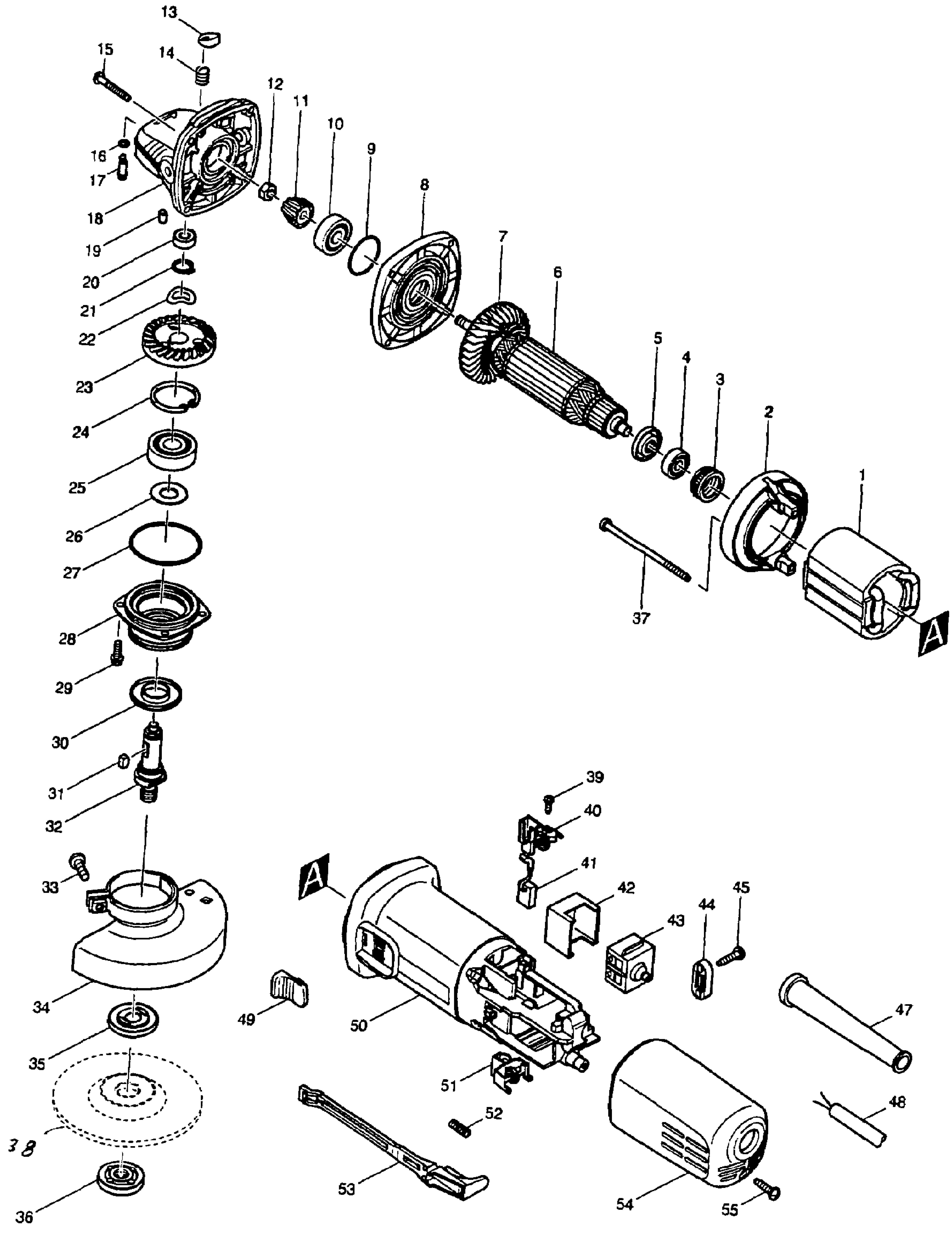


FIG. 2
(PRIOR ART)

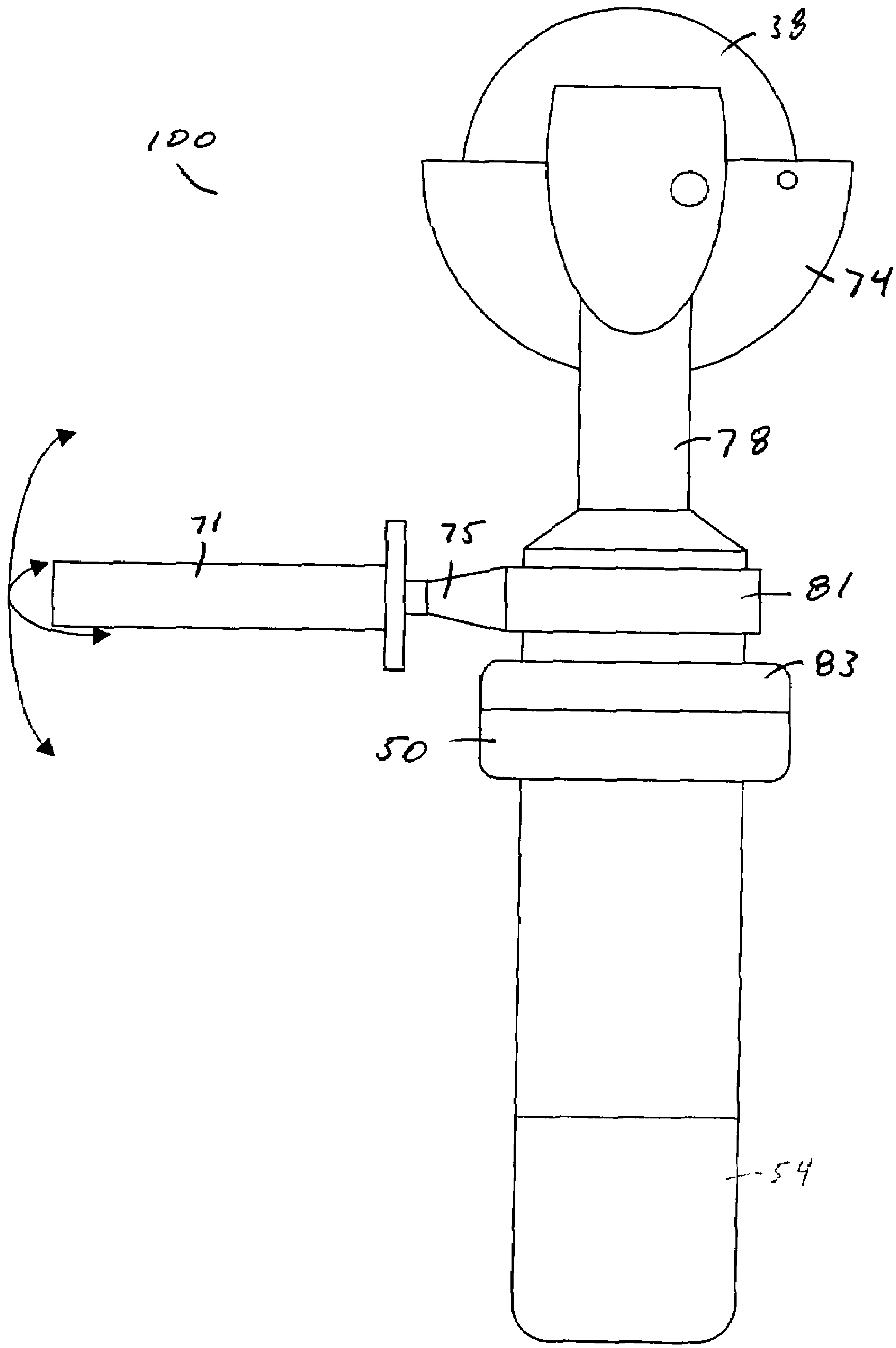


FIG 3

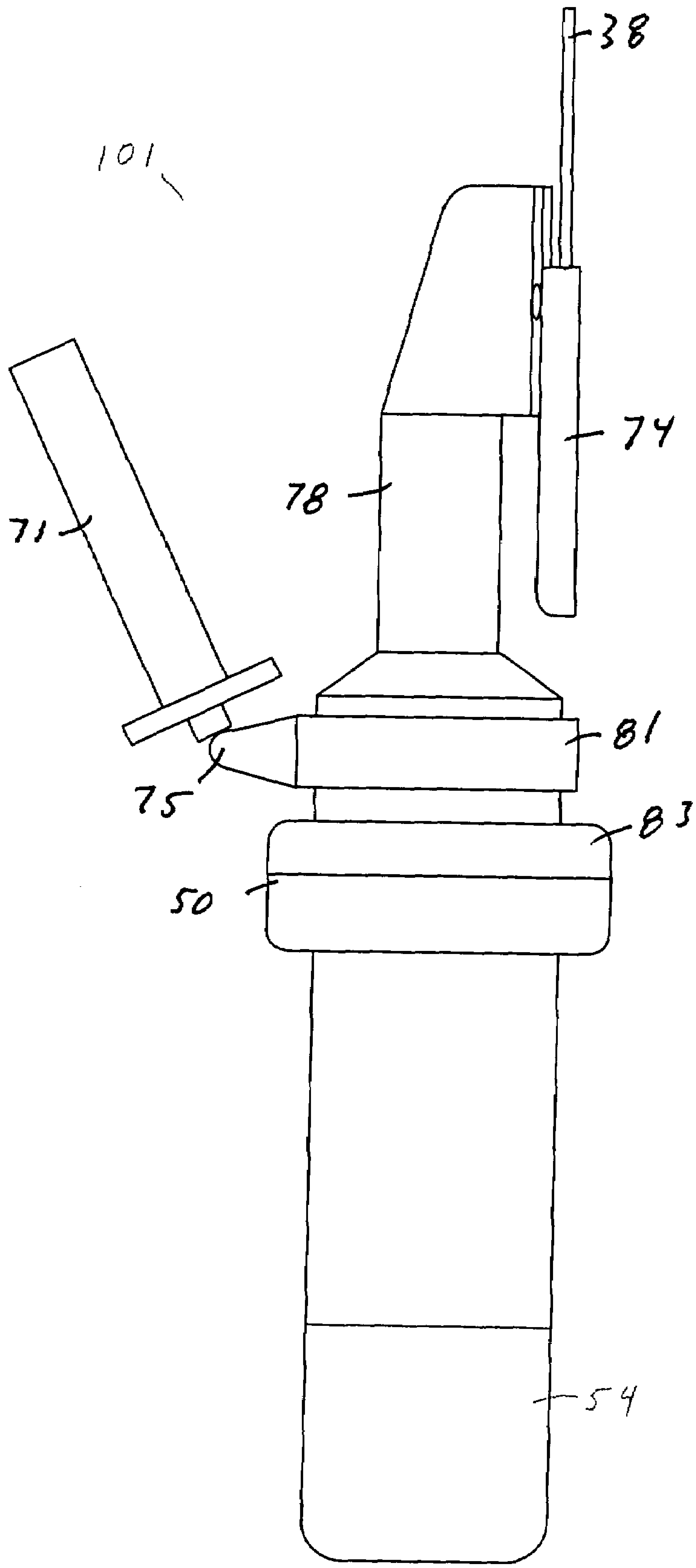


FIG 4

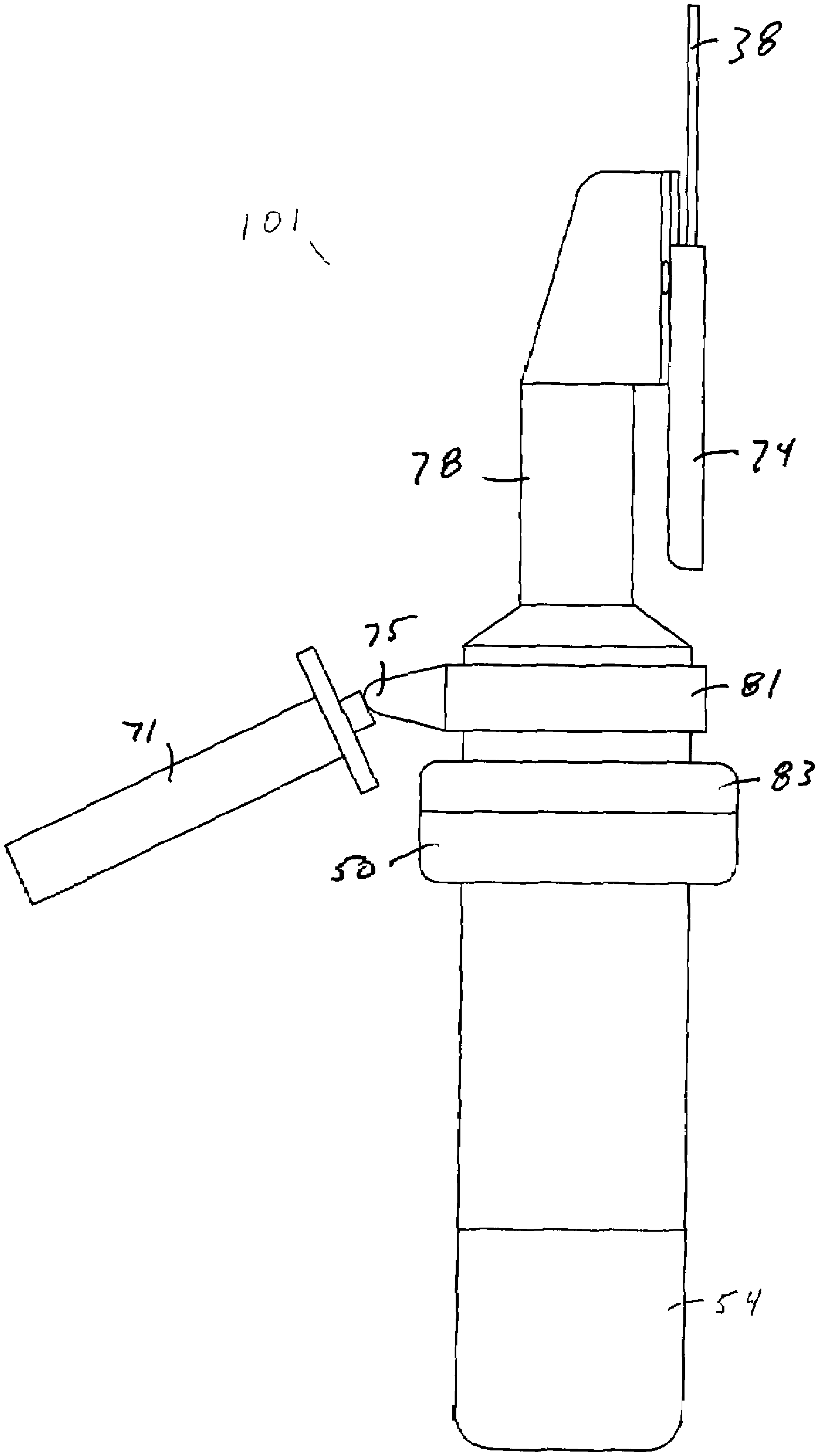


FIG 5

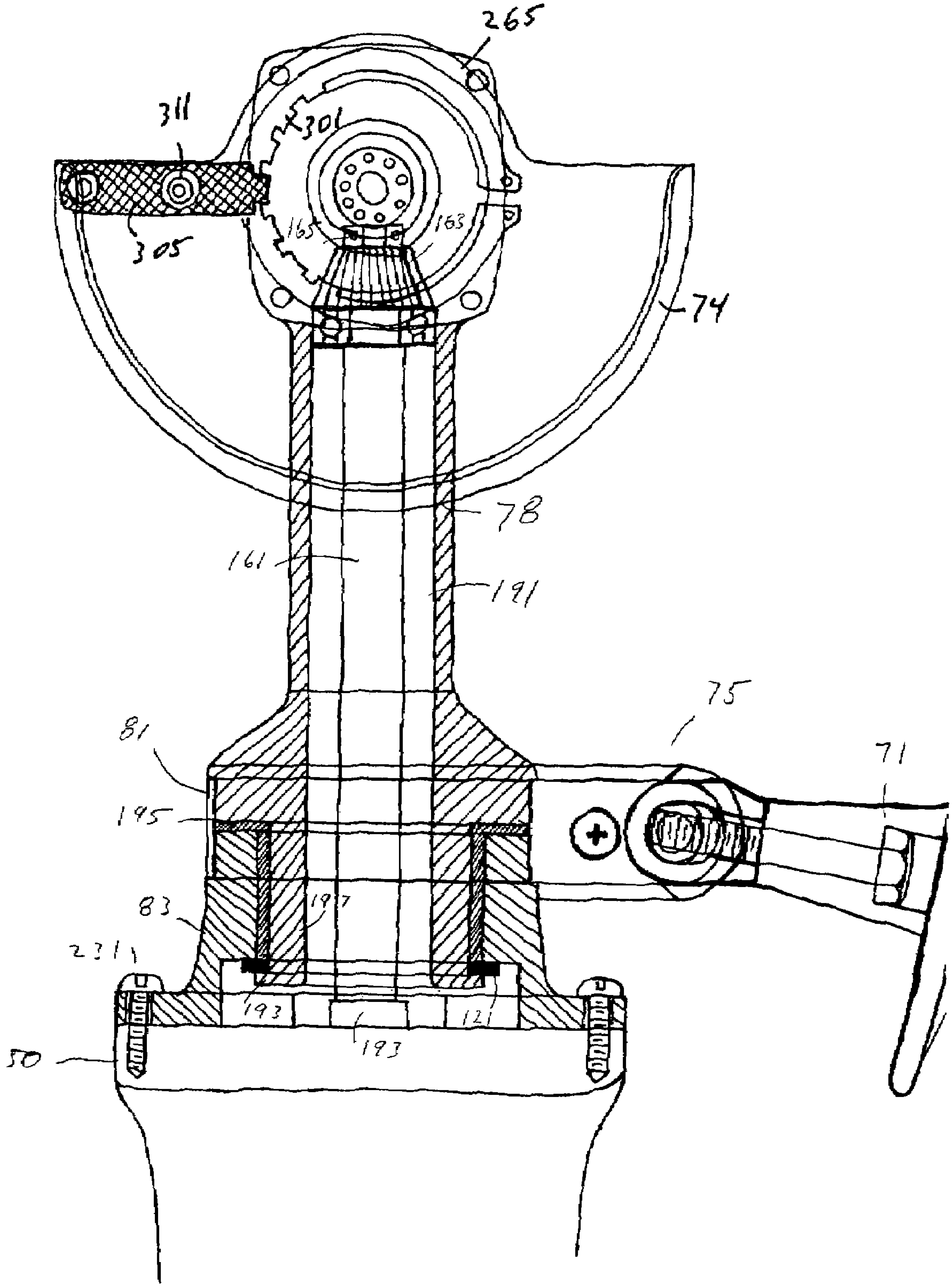

265
311
301
305
165
163
74
78
161
191
75
81
71
195
83
197
231
193
121
193
50

FIG. 6

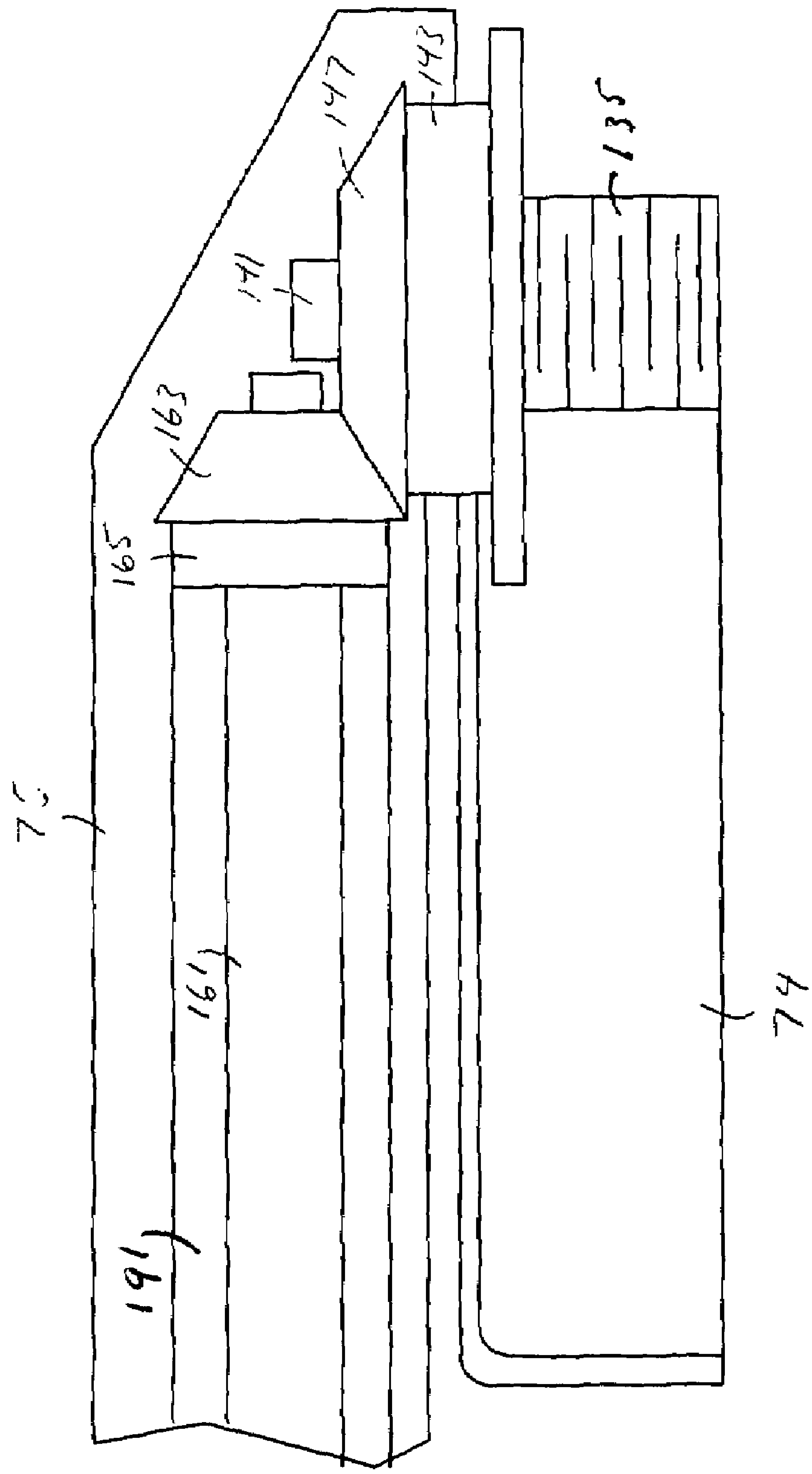


FIG 7

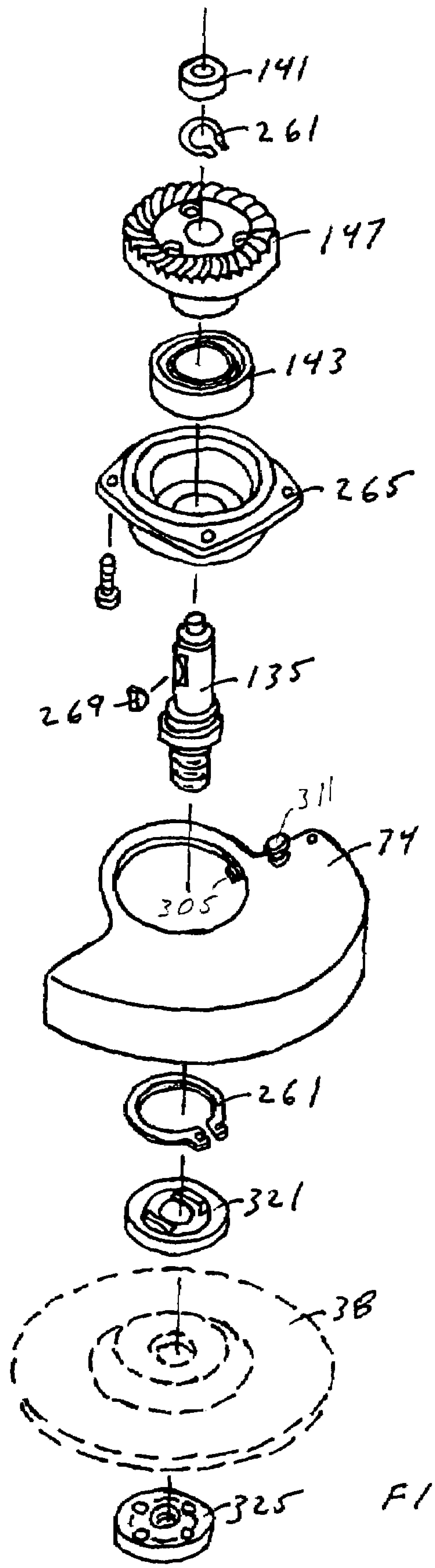


FIG 8

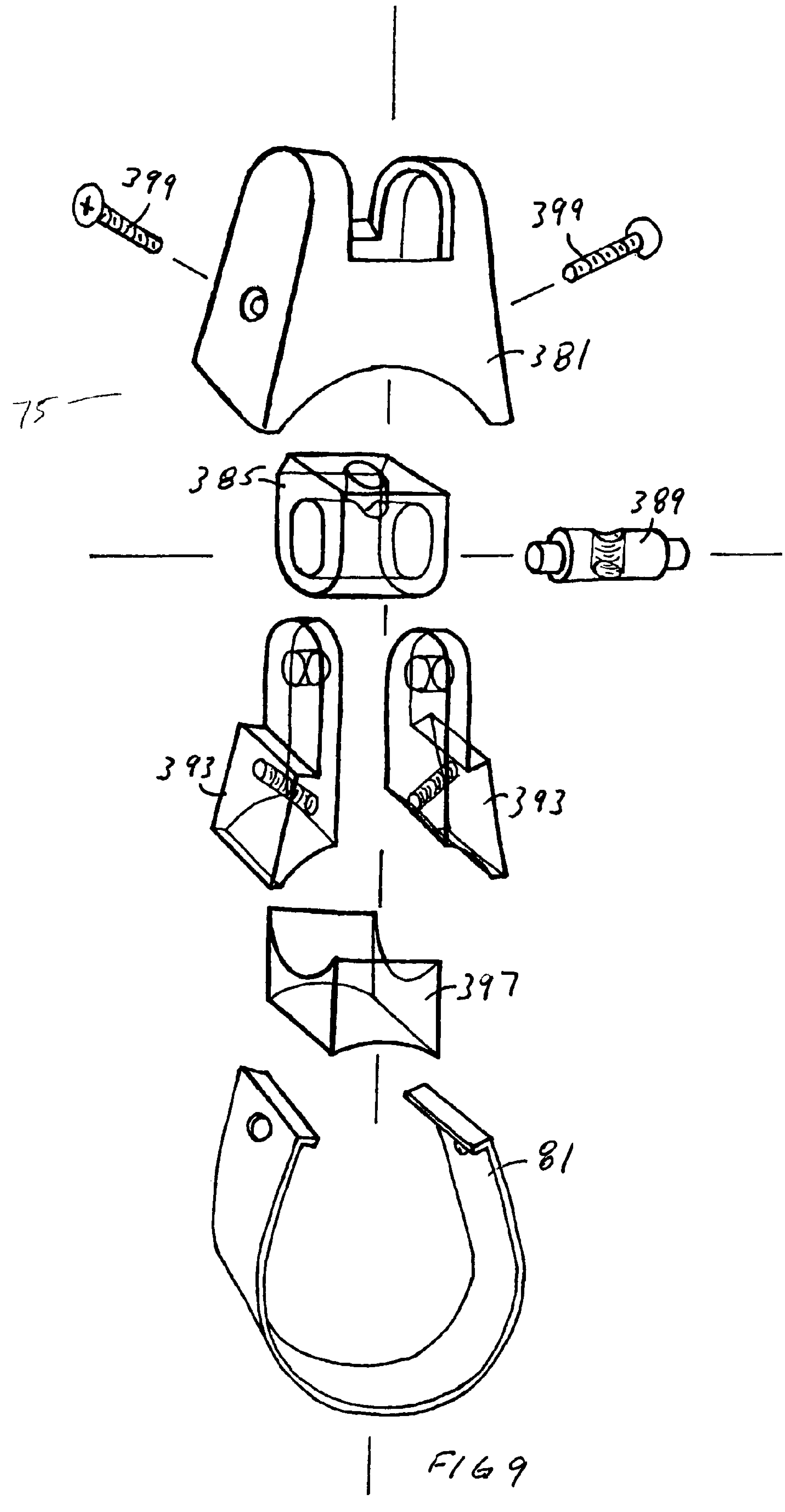


FIG 9

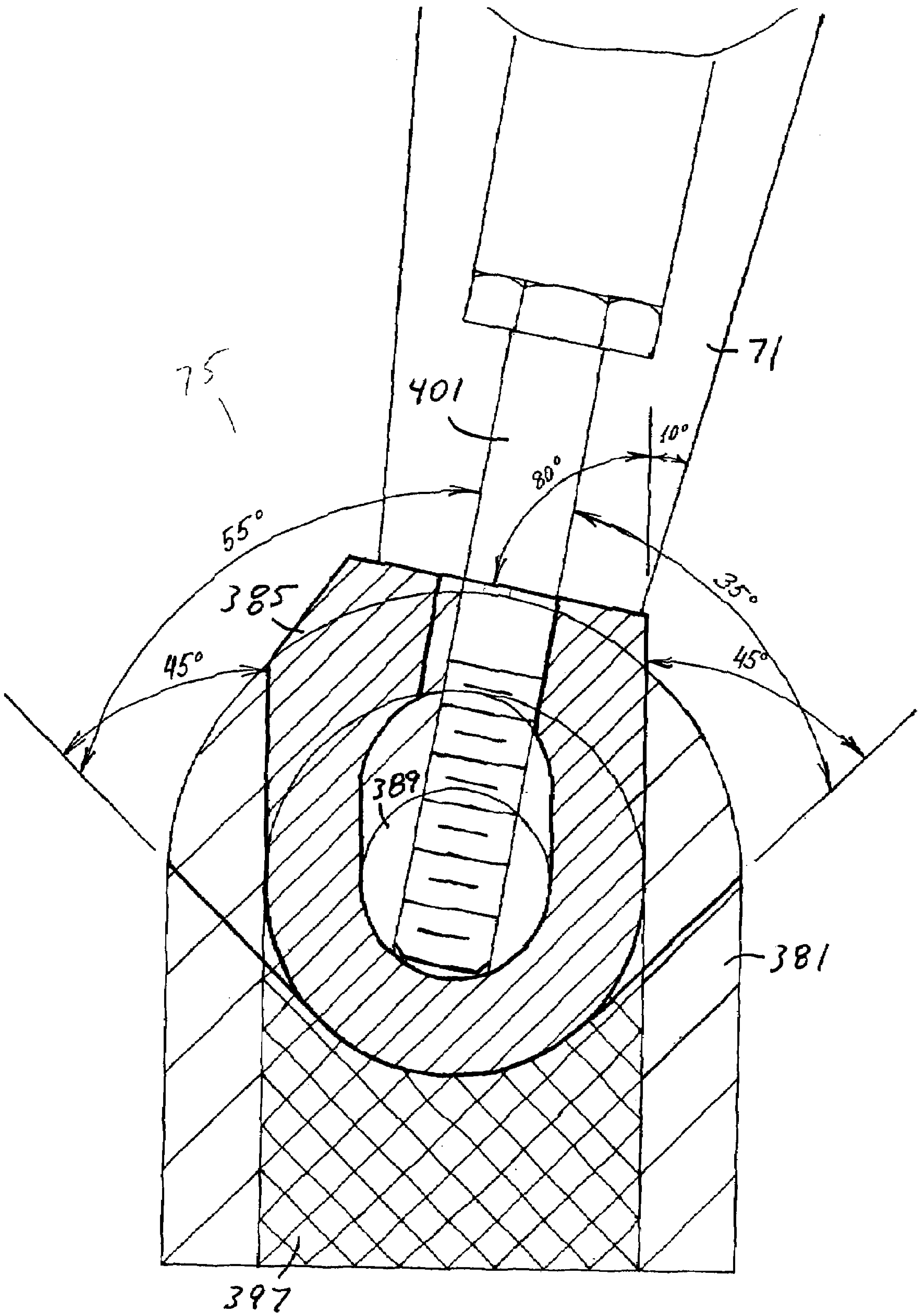


FIG 10

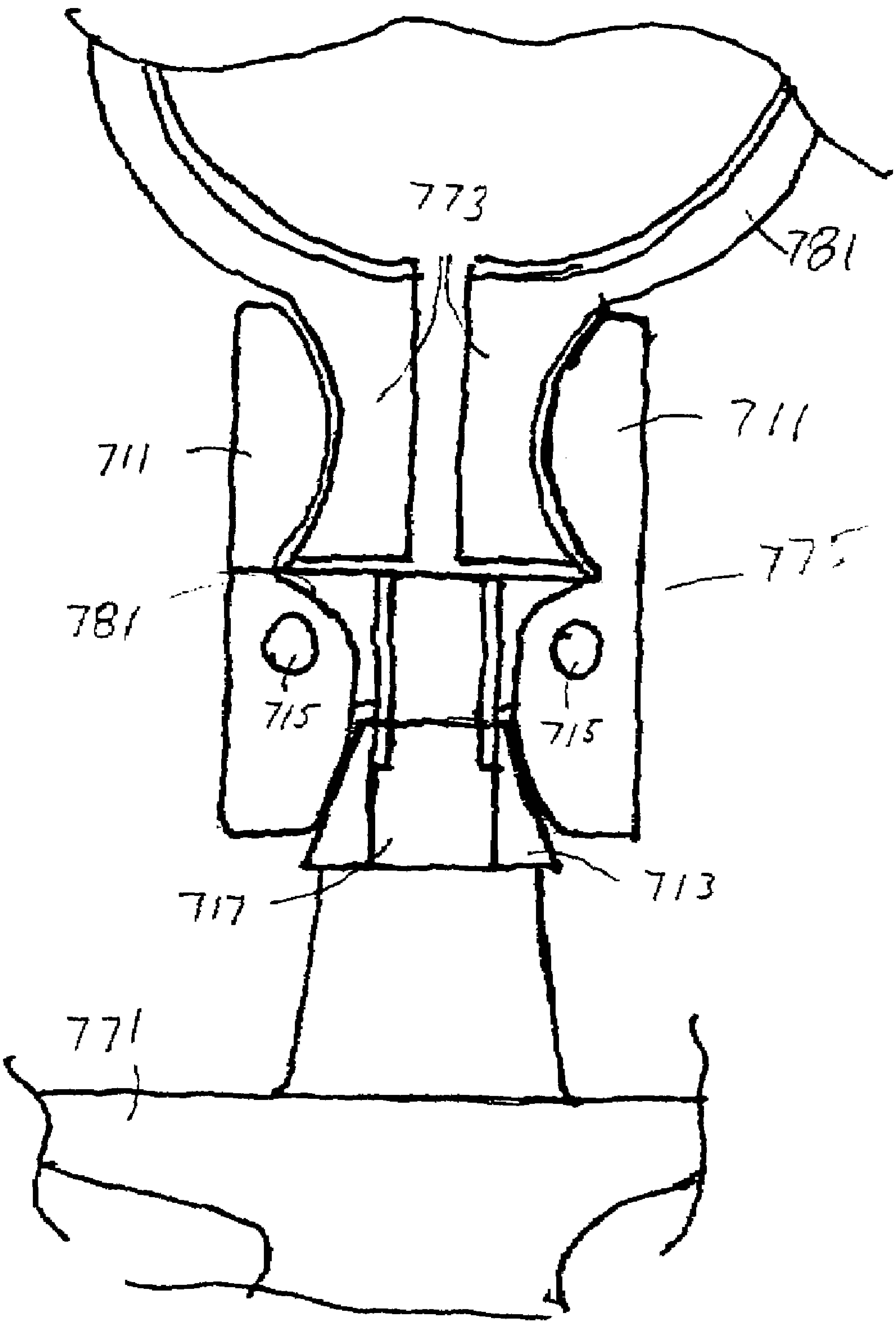


FIG. 11

ADJUSTABLE HANDHELD TOOL

CROSS REFERENCE TO RELATED PATENT APPLICATIONS

This applications claims priority to U.S. Provisional Application No. 60/781,045 "Adjustable Handheld Tool" which was filed on Mar. 10, 2006 and is hereby incorporated by reference.

BACKGROUND

Handheld power tools may require holding the tools in a variety of positions in order to cut, grind, drill, fasten, or perform other operations on a workpiece. Power tools often have a body and a grip that has a button that allows the user to turn the power tool on and off. At the opposite end of the grip is the tool head, which has a tool disk that is angled relative to the axis of the body. The power tool is frequently equipped with an auxiliary handle in addition to the operating trigger grip handle. Most of these auxiliary handles are screwed into the tool body. The auxiliary handles can be removed but not moved to a different position on the power tool. Generally, the auxiliary handles are provided as cylinders, tapered cylinders, or bulbous knobs.

FIG. **1** illustrates an existing "angled grinder" power tool. The grinder has a motor housing **50**, a rear cover **54**, a gear housing **18**, an auxiliary handle **61**, a disc tool **38** and a wheel cover **34**. Although the auxiliary handle **61** is shown on the left side of the tool, the position of the handle **61** can be switched to the right side of the tool by moving the handle **61** into a threaded hole **63** in the right side of the gear housing **18**. When the grinder is used, the operator typically grasps the motor housing **50** and rear cover **54** with one hand and the auxiliary handle **61** with the other hand to control the position of the disc tool **38**.

FIG. **2** illustrates an exploded view of an angled grinder power tool. The motor components **1**-**8**, **37** and **39**-**55** are held within the motor housing **50** and the rear cover **54**. The gear housing **18** holds the components **9**-**36** and **38** which include a first bevel gear **11** that is coupled to the end of the motor shaft/armature assembly **7**. The first bevel gear **11** engages a second bevel gear **23** that is coupled to one end of the spindle **32**. The opposite end of the spindle **32** is attached the disc tool **38**. A wheel cover assembly **34** is attached to the bottom cover **28** of the gear housing **18**.

A problem with auxiliary handles is that they are generally fixed in their relationship with the tool body. This can make the tool more difficult to use in tight spaces. Similarly, the tool head is generally fixed relative to the power tool, which limits the angle of the tool disk and may make the tool difficult to use. Another problem with prior art power tools is the tool head can be very thick. A lower profile extended tool head would allow the tool to be used in narrow spaces. What is needed is a power tool that has an adjustable auxiliary handle, adjustable tool head and an extended low profile tool head that addresses the problems with existing power tool grinders.

SUMMARY OF THE INVENTION

The inventive adjustable power tool includes a motor section, a tool head section, an adjustable handle, a disk tool and a tool guard. The motor section includes a motor and a motor housing. The motor is coupled to a drive shaft that extends from the motor housing through a center hole in the tool head. The tool head also has a gear system that is coupled to drive shaft. The disk tool has a center hole and is releaseably

coupled to the drive system by securing the center hole of the disk tool to a threaded spindle and securing the tool between a flange and a lock nut. The lock nut is tightened to secure the disk tool.

The handle is coupled to the power tool at a locking mechanism that is coupled to a ring collar that surrounds a middle section of the power tool at the junction between the motor housing and the tool head. The handle and tool are adjustable in several ways. The tool head can be rotated relative to the motor housing around the coupling joint and around an axle in a clamping mechanism. The axle adjustment allows the handle to be moved forward towards the tool head or backwards towards the motor housing. The tool and handle are locked in placed by tightening the handle into the coupling joint. In an embodiment, the handle is tightened or loosened by rotating the handle axially. The handle tightening causes the coupling joint to tighten against the power tool to prevent rotation between the motor housing and the tool head. Tightening the handle also locks the coupling joint to prevent all axial and rotational movement of the handle relative to the power tool.

In an embodiment, the handle is coupled to a threaded rod that engages a threaded hole in a shoulder axle that is mounted between two strap retaining inserts that are attached to a strap. When tightened, the threaded handle rod pulls up on the threaded shoulder axle that in turn pulls the strap retaining inserts which tighten the strap. Simultaneously, a compression surface on the handle engages a cam that presses on a locking plunger into the side of the tool. This tightening of the locking mechanism prevents the strap and handle from rotating around the tool head and motor housing. Also, the tightening locks the cam against the locking plunger which then prevents axial rotation of the handle about the coupling joint. Thus, a user can lock the handle, the motor housing and tool head into the desired position.

In addition to the adjustable handle, the inventive power tool also has a movable tool guard. The guard is attached to the tool head and covers a portion of the disk tool and blocks pieces that may fly off of the disk tool during use. The guard may be semi-circular and have an edge that partially surrounds the outer diameter of the disk tool. The guard may also have a rotating mechanism that allows the guard to be rotated so that the guard is between the user and the work piece and the working section of the disk tool is clear. A locking mechanism allows the guard to be locked into a desired position. In an embodiment, the guard includes a leaf spring that has an end piece that engages notches in the tool head. The guard is locked in place when the tip of the spring is positioned within one of the notches of the gearbox flange. When a lock button is depressed, the leaf spring is deflected away from the notched ring and the wheel guard is free to rotate to a new position. Once properly positioned, the lock button is released to allow the spring tip to engage another notch in the flange.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevation view of a prior art grinder power tool;

FIG. **2** is an exploded view of the prior art grinder power tool;

FIG. **3** is a top view of the power tool;

FIG. **4** is a side view of the power tool with the handle in a forward position;

FIG. **5** is a side view of the power tool with the handle in a back position;

FIG. **6** illustrates a sectional top view of the power tool;

FIG. **7** illustrates a sectional side view of the tool head;

FIG. **8** illustrates an exploded view of the bevel gear components;

FIG. **9** illustrates an exploded view of the locking mechanism;

FIG. **10** illustrates a cross sectional view of the locking mechanism; and

FIG. **11** illustrates a sectional view of an alternative embodiment of the locking mechanism.

DETAILED DESCRIPTION

The present invention is an improved adjustable hand held tool that has adjustable components. These adjustable components may be an adjustable auxiliary handle, an adjustable tool head, an improved low profile gearing system and an adjustable tool shield. The invention is directed towards a power tool that includes one or more of these improved features. In an embodiment, the present invention uses the motor and motor housing of the prior art grinder illustrated in FIG. **1**. All other illustrated components of the grinder power tool are replaced with the inventive handle, tool head and guard.

FIG. **3** illustrates a top view of an embodiment of the inventive adjustable power tool **100**. The present invention includes a handle **71** that is attached by a locking mechanism coupling joint **75** that is attached to a collar **81**. The collar **81** holds the tool head barrel extender **78** to the motor cover **83**. The motor cover **83** is attached to the motor housing **50** and rear cover **54**. The motor cover **83**, motor housing **50** and rear cover **54** may be collectively referred to as the motor housing **50**. In the preferred embodiment, the collar **81** is a cylindrical ring and the sections of the barrel extender **78** and motor housing **50** that are under the collar **81** are cylindrical. The inventive tool also includes a wheel guard **74** and a tool wheel **38**. Note that the inventive grinder has a tool head barrel extender **78** is longer and has a much lower profile than the prior art gear housing **18** illustrated in FIG. **1**. This allows the inventive power tool **100** to be used in smaller spaces than prior art grinders.

In an embodiment, the handle **71** is coupled to a threaded rod (not shown) that engages the locking mechanism coupling joint **75**. With the handle **71** loosely engaging the coupling joint **75**, the handle **71** and tool head **78** can be adjusted relative to the motor housing **50**. The handle **71** can be moved forward and back about the locking mechanism coupling joint **75**. The handle **71** and coupling joint **75** can also rotate with the collar **81** around the center axis of the power tool **100**. The tool head **78** and motor housing **50** are also able to rotate relative to each other about the center axis of the tool **100**.

When the handle **71** is screwed into the locking mechanism coupling joint **75**, a plunder (not shown) is pressed against portions of the motor housing **50** and the tool head **78**. The friction between the compression member, the motor housing **50** and the tool head **78** prevents any movement between the tool head **78**, the motor housing **50** and the collar **81**. In other embodiments, tightening the handle **71** causes the collar **81** to tighten around the motor housing **50** and the tool head **78** and also causes the motor housing **50** to be pressed against the tool head **78** and the friction between these components prevents relative movement and locks the components into their set positions.

With reference to FIG. **4**, another view of the inventive power tool **100** is shown with the tool head **78** and handle **71** moved into different positions. The handle **71** is positioned forward over the tool head **78** and the tool head **78** has been rotated to be perpendicular to the handle **71**. FIG. **5** illustrates the handle **71** rotated towards the motor housing **50** and the tool head **78** perpendicular to the handle **71**. The inventive power tool **101** allows the tool head **78** to rotate axially relative to the motor housing **50** and the handle **71** to rotate around the tool and as well as forward and backwards around the coupling joint **75**.

The internal components of an embodiment of the inventive adjustable tool are illustrated in FIGS. **6-10**. FIG. **6** illustrates a cross section of the inventive tool. The motor cover **83** has a flange that is attached to the motor housing **50** with a plurality of fasteners **231** and a tubular section that extends away from the flange. A barrel extender **78** is a tubular structure that extends from the motor cover **83**. A cylindrical bushing **195** is placed between the motor cover **83** and the barrel extender **78** at the junction of these components. The bushing **195** provides a smooth sliding surface and allows the tool head barrel extender **78** to rotate relative to the motor cover **83**. The bushing **195** may be made of a plastic material such as nylon, Delrin, Teflon or other lubricated plastic material. During assembly, the bushing **195** is placed on the barrel extender **78** which is then inserted into the motor cover **83**.

A lock ring **121** is attached to a lip portion **193** of the barrel extender **78** to secure the barrel extender **78** to the motor cover **83**. The lock ring **121** is well known in the mechanical arts and is normally a flat circular piece of metal that is not closed. The inner and outer diameters of the lock ring **121** can expand or contract by flexing the circular material. The ends of the lock ring can have holes that can engage a special lock ring tool for installation or removal. After assembly, the lock ring **121** is placed over the lip **193** of the barrel extender **78**. The bushing **195** has a smooth sliding surfaces that allows the tool head **78** to rotate axially relative to the motor cover **83**.

A collar **81** surrounds the outer junction of the motor cover **83** and the barrel extender **78**. In an embodiment, the collar **81** is a strap made of a strong flexible metal, a thicker machined metal or a composite fiber construction. In other embodiments, the collar **81** may be made of any other strong material. The collar **81** is coupled to a locking mechanism coupling joint **75** that is attached to the handle **71**.

In an embodiment, axial rotation of the handle **71** relative to the locking mechanism coupling joint **75** loosens or tightens the collar **81** and the locking joint **75**. Normally, clockwise rotation causes tightening and counter-clockwise rotation loosens, however the locking joint **75** can be configured to tighten or loosen in either rotation. When the handle **71** and locking mechanism **75** are loose, the handle **71**, the collar **81**, the motor housing **50** and barrel extender **78** are all free to rotate relative to each other. When the strap **83** is tightened by the locking assembly **173**, the barrel extender **78** and handle **71** are locked in place relative to the motor housing **50**. The locking mechanism coupling joint **75** will be described in more detail later in the application.

With reference to FIG. **7**, the drive shaft **161** extends through the center of the motor cover **83** and the bore **191** within the barrel extender **78**. The end of the drive shaft **161** is coupled to a bearing **165** mounted with the barrel extender **78** and a drive gear **163**. The bearing **165** can be a sealed ball bearing, roller bearing, bushing or any other low friction rotation support mechanism. The drive gear **163** engages a bevel gear that is coupled to a spindle **135** that has a threaded end. The spindle **135** is supported by a first ball bearing **141** mounted above the bevel gear **147** and a second ball bearing **143** mounted below the bevel gear **147**. When the drive shaft **161** rotates, the drive gear **163** causes the bevel gear **147** and the spindle **135** to rotate. A disk tool is mounted on the threaded end of the spindle **135** and a lock nut is used to secure the disk tool to the spindle **135**.

An exploded view of an embodiment of the spindle assembly **251** is shown in FIG. **8**. The first ball bearing **141** is attached to the top of the spindle **135**. A retaining ring **261** engages a slot in the spindle **135** and is mounted between the ball bearing **141** and the bevel gear **147**. The second ball bearing **143** is mounted under the bevel gear **147** and these components are secured to the barrel extender **78** with a gearbox flange **265** and a plurality of fasteners. A woodruff key **269** is attached to the side of the spindle **135**.

In an embodiment, the wheel guard **74** has a central circular hole that surrounds a tubular portion of the gearbox flange **265**. A lock ring **261** engages a slot in the gearbox flange **265** and holds the wheel guard **74** against the gearbox flange **265**. The lock ring **261** allows the wheel guard **74** to rotate about the gearbox flange **265**.

The disk tool **38** is mounted on the bottom of the spindle **135** between a wheel flange **321** and a lock nut **325**. The disk tool **38** is attached or removed from the spindle **135** when the bevel gear **147** is locked so that it cannot rotate. The tool head includes a lock button (not shown) that engages the bevel gear **147** and prevents the spindle **135** from rotating. To attach the disk tool **38**, the user first actuates the lock button places the disk tool **38** and lock nut **325** on the threaded end of the spindle **135**. The user then tightens the lock nut **325** with a wrench. When the lock nut **325** is tight, the user releases the lock button before using the power tool. To remove the disk tool **38** the user stops the tool and presses the lock button. The user then loosens and removes the lock nut **325** to remove the disk tool **38**. In an embodiment, the lock nut **325** has a plurality of holes that are used to rotate the lock nut **325**. In the case, a special wrench such as a spanner wrench, is used to tighten and loosen the lock nut **325** that has pins that engage holes.

With reference to FIG. **6**, in an embodiment, the gearbox flange **265** includes a plurality of slots **301**. An end of the leaf spring **305** is attached to the wheel guard **74**. The attachment method may be a rivet, weld, fastener, solder, or any other fastening device. The tip **307** of the leaf spring **305** engages one of the plurality of slots **301** to prevent rotation of the wheel guard **74**. A portion of the wheel guard lock button **311** passes through a hole in the wheel guard **74** and is exposed on the upper side of the wheel guard **74**. When the lock button **311** is pressed, the leaf spring **305** is deflected and the tip **307** is removed from the slot **301**. This allows the wheel guard **74** to be moved and locked in a new position. When the lock button **311** is released, the tip **307** of the leaf spring **305** returns to the slots **301** and the wheel guard **74** is locked into a new position.

With referent to FIG. **9**, an exploded view of an embodiment of the locking mechanism **75** and the collar **81** is illustrated. The locking mechanism **173** includes: a housing **381**, a cam **385**, a threaded axle **389**, retaining inserts **393** and a locking plunger **397**. The housing **381** is a hollow tapered structure that has lower edges that are concave and similar in shape to the circular section of the tool and a convex cylindrical upper surface with a hole. The other locking mechanism **173** components are at least partially mounted within the housing **381**. The cam **385** has a vertical hole and an elongated horizontal hole that intersect within the cam **385**. The upper surface of the cam **385** is a flat angled surface and the bottom is a convex cylindrical surface. The cam **385** is preferably made of a metal such as aluminum, steel, brass or any other strong metal.

The locking plunger **397** has a rectangular cross section and concave cylindrical upper and lower surfaces. The radius of the upper concave surface of the plunger **397** matches the radius of the convex cylindrical shape of the bottom of the cam **185**. The radius of the lower concave surface of the plunger **397** matches the cylindrical surface at the junction of the motor housing **83** and the barrel extender **78**. The locking plunger **397** is preferably made of a plastic material such as Delrin, Nylon, Teflon or similar plastic materials. However, in other embodiments, the plunger **397** can be made of any other solid strong material, such as metal, composite, ceramic or plastic.

The strap retainers **393** are fastened to the ends of the collar **81** and are mounted on opposite sides of the cam **385**, axle **389** and locking plunger **397**. There are numerous ways to secure the collar **81** to the strap retainers **393**. In an embodiment, the ends of the collar **81** are bent inwards to form corners and holes are drilled in the ends. The retainers **393** have corresponding corners that engage the bent portions of the collar **81**. The housing **381** and the retainers **393** have holes threaded holes that allow the collar **81** to be secured between the housing **381** and the retainers **393** with fasteners **399**. The fasteners **399** are placed through the holes in the housing **381**, the collar **81**. The fasteners **399** are tightened into the threaded holes in the retainers **393**. This prevents movement between the collar **81**, retainers **393** and housing **381**. The fasteners **399** may be screws, bolts, rivets or other type of fastening mechanism.

The inner surfaces of the retainers **393** are smooth planar surfaces that allow the cam **385** and locking plunger **397** to slide vertically against the retainers **393**. The axle **389** is placed through the horizontal slot in the cam **385** and the ends of the axle **389** engage holes in the retainers **393**. The axle **389** is free to rotate within the retainers **393**. The axle **389** has a threaded hole that runs across the center width of the axle **389**. The threaded hole is positioned in line with the vertical hole in the cam **385**. This orientation allows a threaded rod of the handle **71** to pass through the vertical hole in the cam **385** and be secured to the threaded hole in the axle **389**.

The handle **71** includes a compression surface that engages a portion of the locking joint mechanism **75**. When the handle **71** is tightened against the locking mechanism **75**, the compression surface of the handle **71** pushes down on the top of the cam **385** and plunger **397** while the threaded rod pulls up on the axle **389**. The movement of the axle **389** pulls the retainers **393** up which tightens the collar **81** around the power tool. Simultaneously, the downward force on the cam **385** against the locking plunger **397**. Because the junction of the cam **385** and the plunger **397** are matching cylindrical surfaces, there can be some rotational movement between these pieces as well as angular movement of the applied compression force. The compression force is aligned with the threaded rod. Regardless of the compression force angle, there is still a large contact area between the cam **385** and the plunger **397**. When the handle **71** is tightened, this compression causes friction between the cam **385** and the plunger **397** preventing relative movement between these pieces. This locks the handle **71** and prevents rotation relative to the locking joint mechanism **75**.

The tightening of the handle **71** and downward force on the cam **385** also pushes the locking plunger **397** against the motor housing **83** and the barrel extender **78**. Because the plunger **397** is made of a relatively soft material, the compressed bottom surface area conforms to the contact shape of the motor housing **83** and the barrel extender **78**. The plunger **397** is compressed with sufficient force and friction to lock the motor housing **83** and the barrel extender **78** in place and prevent relative movement.

As discussed, the handle **71** can rotate about the locking mechanism **173**. In an embodiment, this rotation is limited by the locking joint mechanism **75**. With reference to FIG. **10**, a cross section view of the locking mechanism **173** is shown. The handle **71** includes a threaded rod **401** that passes through the vertical hole in the cam **385** and is secured to the threaded hole in the axle **389**. In this embodiment, when the cam **385** is vertically oriented (as shown) the upper surface of the cam and the handle **71** are angled at 10 degrees towards the disk tool. The bottom of the cam **385** has a convex cylindrical surface and the upper surface of the plunger **397** has a corresponding concave cylindrical surface. The upper surface of the plunger **397** and the housing **381** allow the cam **385** to be rotated across a range of angles. In this embodiment, the range of angles is about 90 degrees. The angled edges of the housing **381** and the upper surface of the plunger **397** prevent additional movement beyond the 90 degrees of travel. Because the top of the cam **385** is angled at 10 degrees towards the disk tool, the handle **71** can move 55 degrees forward of vertical center and 35 degrees back from vertical. In other embodiments, the range of movement can be altered to provide a wider or narrower range of travel. In this embodiment, the range of travel is intended to prevent the handle **71** and user's hands from contacting the disk tool or the motor housing.

In a normal power tool gearing system shown in FIG. **2**, the bevel gear **23** is mounted in a gear housing **18** and required a great number of additional components such as: bearings **20**, retaining rings **21**, washers **22**, spindle **32**, etc. Because there are many components the mechanism is more complex than necessary and requires a wide gear housing **18**. This large gear housing **18** is problematic when the tool must be used in tight spaces. By improving the design of the gear housing by using fewer parts, the inventive power tool head is substantially thinner and can be used in more confined spaces. The narrower design is possible because the second bevel gear **147** used in the inventive hand held tool is substantially different than the prior art power tool gear mechanisms as illustrated in FIGS. **1** and **2**.

Although the present invention has been described in a specific embodiment, other mechanisms are contemplated that perform the same functionality. With reference to FIG. **11**, an alternative embodiment of the locking mechanism **701** is illustrated as a cut away view of the locking joint mechanism **775**. The two flanges **773** of the collar **781** are coupled to the handle **771** through a locking joint mechanism **775** that includes several mechanical components. The locking joint mechanism **775** allows the handle **771** and tool head **778** to be adjustable and also locks these components in a position desired by the user. The flanges **773** have concave spherical surfaces that engage two convex spherical surfaces on two members **711**. The spherical surfaces provide a large contact surface area and allow the convex spherical surface of the members **711** to rotate against the concave spherical surfaces of the flanges **773**.

The members **711** rotate about pivot rods **715** that are coupled to the body **781** of the joint mechanism **775**. The body **781** has an upper surface (not shown) and a lower surface that engages the ends of the pivot rods **715** and hold the members **711** on the pivot rods **715**. When the members **711** rotate towards the flanges **773**, the collar **781** diameter decreases locking the motor cover **750**, the tool head and handle **771** in position.

The body **781** also has a threaded center bore. The members **711** are rotated by the movement of a wedge **713** that is placed on a shaft **717** at the end of the handle **771**. The wedge **713** has a center hole and two tapered and planar wedge surfaces. The shaft **717** is threaded into the center bore in the body **781**. When the handle **771** is rotated about its center axis, the threads of the shaft **717** engage the threads in the body **781** and the shaft **717** move the wedge **713**. If the handle **771** is rotated clockwise, the shaft **717** is pulled into the body **781** and the wedge is forced between the members **711**. The rotation of the members **711** causes the spherical surfaces to clamp onto the flanges **773** locking joint mechanism **775**. Conversely, if the handle is rotated **771** counter-clockwise, the shaft **717** moves away from the body **781** and the wedge moves away from the members **711** loosening the collar **781**. In an embodiment, the joint mechanism **775** has a locking mechanism that prevents the rotation of the handle **771** and shaft **717** from the body **781**. This locking mechanism may prevent the accidental unlocking of the handle **771**.

It is contemplated that various other locking joint mechanisms can be used with the present invention. For example, the handle **771** may have a tapered inner diameter that engages an outer surface of the members **711**. By screwing the handle **771** into the housing, the inner diameter causes the members **711** to tighten around the flanges **773** causing the collar **781** to tighten which locks the handle **771** in place. Additional details of the alternative embodiment are disclosed in U.S. Provisional Application No. 60/781,045.

In the preferred embodiment, the components of the inventive adjustable handheld tool are made of metals or metal alloys that are easily machinable. Typical metals used include: aluminum/aluminum alloys, steel alloys such as tool steel 4042, Stainless steels, brass and any other type of suitable metal. The components may be formed from castings, billets, bar/rod stock, etc. The components may be machined with lathes, drills, and CNC machines. Some of the components may be commonly available items such as bearings, nuts, lock rings, o-rings and gears.

While the present invention has been described in terms of a preferred embodiment above, those skilled in the art will readily appreciate that numerous modifications, substitutions and additions may be made to the disclosed embodiment without departing from the spirit and scope of the present invention. For example, it is also possible to use the present invention in various other types of hand tools such as: planers, drills, routers, saws, etc. The inventive adjustable handle system can also be used with other hand-operated devices such as handlebars, lawn mowers, edges, chainsaws, or any other mechanisms that use handgrips. It is intended that all such modifications, substitutions and additions fall within the scope of the present invention that is best defined by the claims below.

What is claimed is:

1. An adjustable power tool comprising:

a handle coupled to a threaded rod;

a power tool housing;

a locking mechanism coupling the handle to the housing, the locking mechanism comprising:

a cam having a curved surface, a first hole and a second hole wherein the first hole and second hole intersect;

an axle having a threaded hole wherein the axle is mounted within the second hole of the cam;

a plunger that is mounted between the power tool housing and the curved surface of the cam; and

a collar that is coupled to the axle and surrounds a portion of the power tool housing;

wherein the threaded rod is coupled to the threaded hole in the axle and when the threaded rod is rotated in a first direction within the threaded hole, the collar and handle can rotate around a center axis of the power tool and when the threaded rod is rotated in a second direction within the threaded hole, the collar tightens around the power tool housing and the cam presses the plunger against the power tool housing locking the handle against rotation.

2. The power tool of claim **1** wherein the curved surface of the cam has a cylindrical shape and the upper surface of the plunger has a corresponding cylindrical surface that engages the curved surface of the cam, wherein when the threaded rod is rotated in the second direction within the threaded hole, the plunger is compressed against the power tool housing.

3. The power tool of claim **1** further comprising:

a motor cover portion of the power tool housing; and

a barrel extender portion of the power tool housing;

wherein the collar is coupled to the motor cover and the barrel extender.

4. The power tool of claim **3** wherein when the threaded rod is rotated in a first direction within the threaded hole, the barrel extender can rotate relative to the motor cover.

5. The power tool of claim **1** wherein the axle and the cam can rotate relative to the plunger.

6. The power tool of claim **5** wherein the plunger limits the rotation of the cam.

7. The power tool of claim **1** wherein the axle moves relative to the cam when the threaded rod is rotated in the first direction or rotated in the second direction within the threaded hole.

8. The power tool of claim **1** wherein friction between the cam and the plunger prevent axial movement of the threaded rod and the handle when the threaded rod is rotated in the second direction within the threaded hole.

9. The power tool of claim **3** further comprising:

a slotted ring coupled to the barrel extender;

a wheel guard that is coupled to the barrel extender; and

a leaf spring coupled to the wheel guard;

wherein the wheel guard is rotatable around a portion of the barrel extender and the leaf spring engages a portion of the slotted ring to prevent the rotation of the guard wheel.

10. The power tool of claim **9** further comprising:

a locking button that is coupled to the leaf spring;

wherein when the locking button is actuated, the loaf spring disengages from the slotted ring so the wheel guard can rotate around the portion of the barrel extender.

11. An adjustable power tool comprising:

a power tool housing;

a collar that is attached to the power tool housing;

a locking mechanism that is coupled to the collar; and

a handle that includes a threaded rod that is coupled to the locking mechanism;

wherein when the threaded rod is rotated in a first direction relative to the locking mechanism, the collar is movable around the power tool housing and the handle is movable relative to the power tool and wherein when the threaded rod is rotated in a second direction relative to the locking mechanism, the locking mechanism tightens the collar around the power tool housing preventing the collar from moving around the power tool housing and locking the handle in place preventing the handle from moving relative to the power tool housing.

12. The power tool of claim **11**, wherein the locking mechanism includes a cam and a plunger that are mounted between the handle and the power tool housing and when the threaded rod is rotated in a second direction relative to the locking mechanism the cam compresses the plunger against the power tool housing.

13. The power tool of claim **12** wherein the cam has a cylindrical surface and the plunger has a corresponding adjacent cylindrical surface that allows the cam to rotate relative to the plunger.

14. The power tool of claim **11** wherein a portion of the handle contacts the locking mechanism when the threaded rod is rotated in a second direction relative to the locking mechanism.

15. The power tool of claim **11** wherein the locking mechanism includes a compression device that tightens the collar around the power tool housing when the threaded rod is rotated in a second direction relative to the locking mechanism.

16. The power tool of claim **15** wherein the collar has a split section and a flange attached to each end of the clamp and the compression mechanism presses the two flanges towards each other when the threaded rod is rotated in a second direction relative to the locking mechanism.

17. The adjustable power tool of claim **11** further comprising:

an elongated barrel extender having a center hole;

a drive shaft that is mounted in the center hole and coupled to a drive gear;

a spindle coupled to a bevel gear that engages the drive gear; and

a disk tool coupled to one end of the spindle.

18. The power tool of claim **11** further comprising:

a slotted ring coupled to the tool housing;

a wheel guard that is coupled to the barrel extender; and

a leaf spring coupled to the wheel guard:

wherein the wheel guard is rotatable around a portion of the barrel extender and the leaf spring engages a portion of the slotted ring to prevent the rotation of the guard wheel.

19. The power tool of claim **18** further comprising:

a locking button that is coupled to the leaf spring;

wherein when the locking button is actuated, the loaf spring disengages from the slotted ring so the wheel guard can rotate around the portion of the barrel extender.

20. The power tool of claim **11** wherein the threaded rod is mounted along a center axis of the handle.

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